Practice Problems for Common Exam 3

Chapter 12 Sect.1-7 chapter 16 Sect. 1-6 Chapt 17 Sect.1-2 Chapt. 18 Sect. 1-7 Chapter 19 Sect.1-3

1. The intensity at a distance of 4.0 m from a source that is radiating equally in all directions is 9.85 x 10^{-7} W/ m^2. What is the intensity level in dB at a distance of 6 m?
A) 17.8 dB
B) 20.0 dB
C) 26.5 dB
D) 32.2 dB
E) 56.4 dB

2. The intensity of a certain sound wave is $2x10^{-7}$ W/m^2. If its intensity is raised by 30 decibels, what is the new intensity in W/m^2?

A) $6x10^{-5}$ W/m^2
B) $5x10^{-4}$ W/m^2
C) $2x10^{-4}$ W/m^2
D) 6 $x10^{-3}$ W/m^2
E) $2x10^{-2}$ W/m^2

3. A 500-Hz whistle is moved toward a listener at a speed of 10.0 m/s. At the same time, the listener moves at a speed of 20.0 m/s in a direction away from the whistle. What is the apparent frequency heard by the listener? (The speed of sound is 340 m/s.)
A) 463 Hz
B) 485 Hz
C) 533 Hz
D)547 Hz
E) 562 Hz

4. An organ pipe, open at both ends, is 2.2 m long. If the velocity of sound in air is 343 m/s, the frequency of third harmonic of this pipe is:
A) 116 Hz
B) 234 Hz
C) 366 Hz
D) 499 Hz
E) 5640 Hz

5. A violin with string length 32 cm and string density 1.5 g/cm resonates in its fundamental with the first overtone of a 2.0-m organ pipe with one end closed and one end open. What is the tension in the string if the speed of sound in air is 344 m/s?

A) 1000 N
B) 110 N
C) 450 N
D) 4100 N
E) 56 N

6. The attractive electrostatic force between the two point charges $4x10^{-6}$ C and Q has a magnitude of 1.77 N when the separation between charges is 25 cm. The sign and magnitude of the charge Q is closest to

A) + $3x10^{-6}$ C
B) $-3x10^{-6}$ C
C) + $5x10^{-7}$C
D) $-5x10^{-7}$C
E) $+2x10^{-9}$C

7. A 2 mg particle carrying a charge of 4nC is placed in a uniform electric field of magnitude of 100 N/C. Find the particle's acceleration.

A) 0.2 m/s^2
B) 0.85 m/s^2
C) 7.2 m/s^2
D) 80.0 m/s^2
E) 0.0025 m/s^2

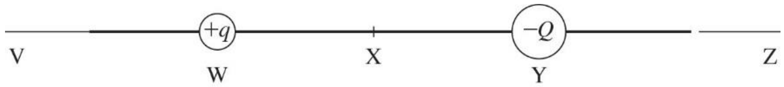
8. How many electrons are removed from a metal ball if the ball is to carry a positive charge of 3.2 nC? ($e=1.6x10^{-19}$C)

A) $5x10^6$
B) $5x10^8$
C) $2x10^{10}$
D) $8x10^2$
E) $2x10^6$

9. Find the magnitude of the electric field in a distance of 2 m from the 6 nC charge.

A) 56 N/C
B) 0.5 N/C
C) 560 N?C
D) 48 N/C
E) 27 N/C

10. The figure shows two unequal charges, +*q* and -*Q*. Charge -*Q* has greater magnitude than charge +*q*. Point X is midway between the charges. In what section of the line will there be a point where the resultant electric field is zero?



A) VW
B) WX
C) XY
D) YZ
E) none of the above

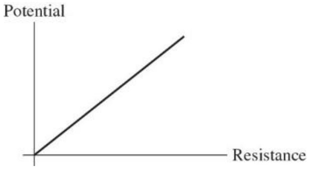
11. Determine the magnitude and direction of the electric field midway between a -8nC and a -6 nC charge 60 cm apart.

A) 200 N/C to the right
B) 200 N/C to the left
C) 1400 N/C to the left
D) 1400 N/C to the right
E) none of the above

12. What is the speed of a proton that has been accelerated from rest through a potential difference of 4.0 kV? (m_p=1.67x10^{-27} kg, e=1.6x10^{-19}C
A) 1.1 x 10^6 m/s
B) 9.8 x 10^5 m/s
C) 8.8 x 10^5 m/s
D) 1.2 x 10^6 m/s
E) 6.2 x 10^5 m/s

13. How strong is the electric field between two parallel plates 8 cm apart if the potential difference between them is 50 V?
A) 625 V/m
B) 25 V/m
C) 0.52 V/m
D) 1250 V/m
E) 156 V/m

14. For the graph shown in the figure, what physical quantity does the slope of the graph represent for ohmic material?



A) current
B) resistivity
C) 1/(current)
D) power
E) 1/(resistivity)

15. A electric heater that draws 13.5 A of dc current has been left on for 10 min. How many electrons that have passed through the heater during that time? (e = 1.60 × 10^{-19} C)
A) 1.5 × 10^{22}
B) 5.1 × 10^{22}
C) 1.8 × 10^{3}
D) 8.1 × 10^{3}
E) 1.0 × 10^{23}

16. When a 1.0-m length of metal wire is connected to a 1.5 V battery, a current of 8.0 mA flows through it. What is the diameter of the wire? The resistivity of the metal is 2.24 × 10^{-8} Ω · m.
A) 12 µm
B) 6.0 µm
C) 24 µm
D) 2.2 µm
E) 45 µm

17. The wiring in a house must be thick enough so it does not become so hot to start a fire. What diameter must a copper wire (ρ = 1.68 x 10^{-8} Ωm) be if it is to carry a maximum current of 30 A and produce no more than 1.6 W of heat per meter of length?
A) 0.025 mm
B) 0.44 mm
C) 3.5 mm
D) 8.4 mm
E) 2.2 cm

18. An electrical heating coil of resistance of 28 Ω is used to heat up a 3.0 kg of water at 20^0C. What is the current in the heating coil if the water warms up to 60^0C in 5 min? (specific heat of water is 4186 J/kg^{0}C)
A) 1.2 A
B) 2.4 A
C) 4.8 A
D) 7.7 A
E) 8.8 A

19. A platinum wire is used to determine the melting point of indium. The resistance of the platinum wire is 2.000 Ω at 20°C and increases to 3.072 Ω as indium just starts to melt. What is the melting point of indium? The temperature coefficient of resistivity for platinum is 3.927×10^{-3}/C°.
A) 116°C
B) 136°C
C) 156°C
D) 251°C
E) 316°C

20. A water pump draws about 0.75 A when connected to 120 V. What is the cost (with electrical energy at 29 cents per kWh) of running the pump for 10 h?
A) 8.0 cents
B) 17 cents
C) 26 cents
D) 95 cents
E) 82 cents

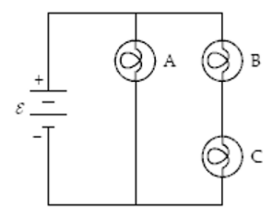
21. What is the resistance of a light bulb that uses an average power of 125 W when connected to **ac** power source with maximum voltage of 250 V?
A) 50 Ω
B) 90 Ω
C) 120 Ω
D)150 Ω
E) 250 Ω

22. An ac voltage of 80V·sin(377rad/s·t) is applied across a resistor of 35 Ω. What is the rms value of the current in this resistor?
A) 1.62 A
B) 1.12 A
C) 0.85 A
D) 0.05 A
E) 2.8 A

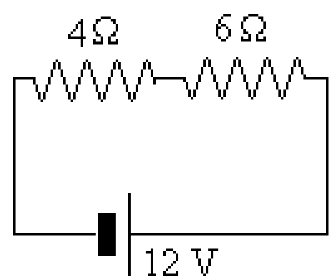
23. When unequal resistors are connected in parallel in a circuit,
A) the same current always runs through each resistor.
B) the potential drop is always the same across each resistor.
C) the largest resistance has the largest current through it.
D) the power generated in each resistor is the same.
E) none of the above

24. The circuit below contains three 100-W light bulbs. Which bulb(s) is (are) brightest?

A) A
B) B
C) C
D) B and C
E) All three are equally bright



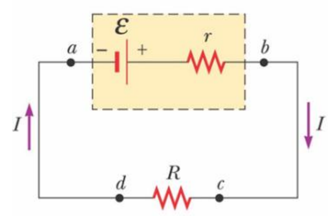
25. The power delivered to the circuit and power dissipated in the 6 Ω resistor are:



A) 8.6 W, 2.25W
B)14.4 W, 8.64W
C)9.56W, 4.87W
D)12.5W, 1.89 W
E)24.0W, 12.8 W

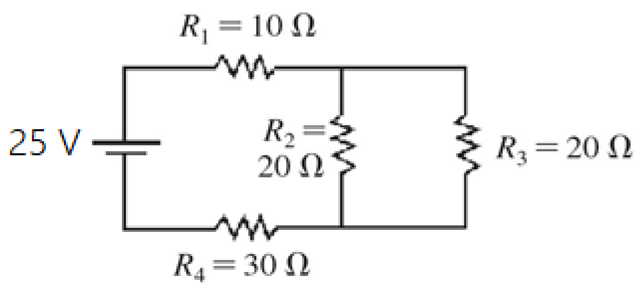
26. If the terminal voltage of the 9- V battery connected across 10- Ω resistor R is 8.4 V, what is the internal resistance of the battery?

A) 0. 9 Ω
B) 8.0 Ω
C) 0.70 Ω
D) 6.4 Ω
E) 0.25 Ω



27. For the circuit shown, find the equivalent resistance of the circuit.

A) 50 Ω
B) 75 Ω
C) 60 Ω
D) 35 Ω
E) 15 Ω



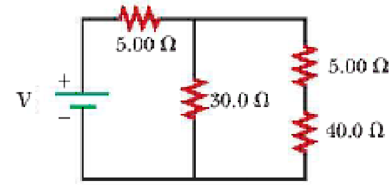
28. For the same circuit, find the current through the battery?

A) 2.0 A
B) 0.75 A
C) 6 A
D) 0.5 A
E) 15 A

29. For the same circuit, find the potential difference across resistor R_2.

A) 2.0 V
B) 25 V
C) 5 V
D) 12 V
E) 15 V

30. If 2.5 A flows through 30-Ωresistor, what is the emf *V* of the ideal battery in the figure?



A) 115 V
B) 75 V
C) 60 V
D) 35 V
E) 15 V

Equations

Conversions: 1 cm $=0.01$ m 1 mm $=0.001$ m 1μm $=10^{-6}$m 1 nm $=10^{-9}$m 1 L $=10^{-3}$m^3

1 kg = 1000 g 1 MJ = 10^6 J 1 mm^2 $=10^{-6}$m^2 1 mile = 1609 m 1 mph = 0.447 m/s 1 atm = 1.013×10^5 Pa

$$T(°C)=\frac{5}{9}[T(°F)-32] \quad T(°F)=\frac{9}{5}T(°C)+32 \quad T(K)=T(°C)+273$$

Areas and Volumes: $A_{circle}=\pi r^2$ $A_{sphere}=4\pi R^2$ $A_{cylinder}=2\pi r\cdot L$ $V_{cube}=a^3$ $V_{sphere}=\frac{4}{3}\pi R^3$

Standing waves on a string: $f_n=\frac{v}{2L}n \quad \lambda_n=\frac{2L}{n} \quad n=1,2,3,..$

Pipe open at both ends: $f_n=\frac{v}{2L}n \quad \lambda_n=\frac{2L}{n} \quad n=1,2,3,..$

Pipe closed at one end: $f_n=\frac{v}{4L}n \quad \lambda_n=\frac{4L}{n} \quad n=1,3,5,..$

$$I=\frac{P}{A}=\frac{P}{4\pi R^2} \quad \beta=10[\text{dB}]\cdot\log_{10}\frac{I}{I_0} \quad I_0=10^{-12}\,\text{W/m}^2 \quad \beta_2-\beta_1=10[\text{dB}]\cdot\log_{10}\frac{I_2}{I_1}$$

$$f_O=f_S\cdot\frac{343\text{ m/s}\pm v_O}{343\text{ m/s}\mp v_S} \qquad \Rightarrow \frac{+}{-} \Leftarrow \qquad \Leftarrow \frac{-}{+} \Rightarrow \qquad \Leftarrow s \frac{+}{+} \Leftarrow o \qquad \Leftarrow o \frac{-}{-} \Leftarrow s$$

Electric charges: $q=N\cdot e \quad F=k\frac{q_1q_2}{r^2} \quad E=k\frac{q}{r^2} \quad k=8.99\times10^9\ \text{Nm}^2/\text{C}^2$

$$F=q\cdot E=m\cdot a \quad q\cdot\Delta V+\Delta K=0 \quad K=\frac{1}{2}mv^2 \quad \Delta V=E\cdot d \quad \Delta U=q\cdot\Delta V$$

$$e=-1.6\times10^{-19}\text{ C} \qquad m_e=9.11\times10^{-31}\text{ kg} \qquad m_{proton}=1.67\times10^{-27}\text{ kg}$$

Electric circuits: $I=\frac{\Delta Q}{\Delta t}=\frac{N\cdot e}{\Delta t} \quad I=\frac{V}{R} \quad P=E/t \quad P=\frac{V^2}{R}=I^2\cdot R=I\cdot V$

$$R=\rho\cdot\frac{L}{A} \quad R(T)=R(20°C)\cdot[1+\alpha\cdot(T-20°C)] \quad \rho(T)=\rho(20°C)\cdot[1+\alpha\cdot(T-20°C)]$$

$$V(t)=V_{\max}\sin(\omega t) \quad I(t)=I_{\max}\sin(\omega t) \quad V_{rms}=\frac{V_{\max}}{\sqrt{2}} \quad I_{rms}=\frac{I_{\max}}{\sqrt{2}} \quad P_{avrg}=\frac{P_{\max}}{2}=\frac{V_{\max}\cdot I_{\max}}{2}$$

$P_{avrg}=I_{rms}^2\cdot R=\frac{V_{rms}^2}{R} \quad \sum E_{emf}=\sum I\cdot R$ Two resistors in parallel: $R_{eq}=\frac{R_1\cdot R_2}{R_1+R_2}$

Resistors in series: $R_{eq}=R_1+R_2+R_3+...$ Resistors in parallel: $R_{eq}=\left[\frac{1}{R_1}+\frac{1}{R_2}+...\right]^{-1}$